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ABSTRACT

This volume is a discussion of research that resulted in a system for developing task summaries for writers of soldier's manuals. It is intended for people who will evaluate the system and for developers of task performance instructions (TPI) and their supervisors. First, some problems with the soldier's manuals, the basic written instructions for performance of critical tasks in most Army jobs, are considered. Some of the findings of research on the design of printed instructions are then addressed. The three principles involved in the model for developing task summaries, called the TPI system, are described sequentially. They are relevance, directness, and sufficiency. A discussion follows of provision in the TPI system for considering the needs of particular kinds of readers. The method section discusses the way the TPI system was developed using an empirical, differential, and structural approach. A demonstration experiment to compare effectiveness of original and revised instructions is described in the final section. These results from the experiment involving instructions on filling out a standard maintenance form are reported: the revision reduced errors in checking entries by 64 percent, and people indicated greater confidence when following the revised instructions and found them much easier to understand. (YLB)

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Technical Report 578

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HOW TO DEVELOP TASK SUMMARIES FOR SOLDIER'S MANUALS

VOLUME I: TECHNICAL REPORT

Elmo E. Miller and Lawrence E. Lyons
Human Resources Research Organization

ARI FIELD UNIT AT FORT HOOD, TEXAS

U.S. DEPARTMENT OF EDUCATION
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April 1982

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A method for improving printed instructions was developed and presented in a guidebook for writers of Soldier's Manuals. The research involved (a) revision of a wide variety of examples, (b) formulation of rules inherent in those revisions, (c) derivation of a taxonomy of tasks to make the method specifically applicable to each kind of task. The method involves increasing directness, particularly in relating text and illustrations, to sharply reduce the burden on short-term memory. It also involves giving sufficient information to specify (cont'd)

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each response, rather than relying upon vague assumptions about "level of background." Effective revisions almost always involve many fewer words, fewer details, but greater specificity, than the original instructions; so one kind of instructions generally is best for novice and expert alike. A demonstration experiment involved instructions on filling out a standard maintenance form. The revision reduced errors in checking entries by 64%; the people indicated greater confidence when following the revised instructions, and found them much easier to understand ($p < .01$, each result).

Technical Report 578

HOW TO DEVELOP TASK SUMMARIES FOR SOLDIER'S MANUALS

VOLUME I: TECHNICAL REPORT

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FOREWORD

The Fort Hood Field Unit of the US Army Research Institute for the Behavioral and Social Sciences (ARI) provides support to Headquarters, TCATA (TRADOC Combined Arms Test Activity) and to III Corps. The support for III Corps involves investigation of training and other human factors problems that are common to FORSCOM units, including individual training.

The modern Army requires large numbers of soldiers to know how to perform a wide variety of tasks. Soldier's Manuals are the basic written instructions on how to do the important tasks for each job.

This report describes a system for developing task performance instructions (TPI) for Soldier's Manuals. Volume I is a report of some related studies, of the method used in developing the system, and a demonstration experiment that was conducted. Volume II is a developer's guide to be used in implementing the system.

The TPI system provides principles for revising the basic structure of instructions to meet particular needs of soldiers. This approach differs from many previous studies, which tended to focus attention on details of wording. One unusual technique is integrating wording and illustrations to specify responses. Another innovation is to cluster instructions so that they apply to specific responses. The approach also involves classification of tasks, so that relatively specific guidance can be given to developers.

ARI research in this area is conducted as an inhouse effort, and as joint efforts with organizations possessing unique capabilities for human factors research. The research described in this report was done by personnel of the Human Resources Research Organization (HumRRO), under Contract No. MDA903-79-C-0191, monitored by Dr. Charles O. Nystrom from the ARI Fort Hood Field Unit. This research is responsive to the objectives of RDTE Project 2Q262717A790, "Human Factors and Training Research in Military Organizations and Systems," FY 1980 Work Program.

Credit and appreciation is due Dr. Robert G. Cooper, who conducted the demonstration experiment reported in Volume I.

JOSEPH ZEIDNER
Technical Director

HOW TO DEVELOP TASK SUMMARIES FOR SOLDIER'S MANUALS.
VOLUME I. TECHNICAL REPORT

BRIEF

Requirement:

Soldier's Manuals (SM) are the basic written instructions for performance of critical tasks in most Army jobs. SM are intended as a sufficient ("one-stop") learning guide for those tasks, and are a key element of the Enlisted Personnel Management System (EPMS). Since they first appeared in 1976, SM have demonstrated great promise, but various kinds of problems have also become apparent, as might be expected in so vast a system.

The major research objective is a system for improving task performance instructions (TPI) in SM. A related objective is a developer's guide for implementing that system.

Procedure:

Several task summaries from current SM were revised to serve as examples, and to provide an empirical basis for the principles of revision. The method involves basic restructuring of TPI to meet the needs of the soldier. A classification of tasks was developed so that guidance for developers is relatively specific.

Principal Findings:

- Instructions in SM could be much briefer and more effective.
- TPI may be improved substantially by techniques using illustrations to specify action.
- Different instructional strategies are needed for different kinds of tasks.
- Task performance and reader confidence are improved significantly when instructions are revised by the TPI system.

Utilization of Findings:

Soldier's Manuals may be improved by following the Developer's Guide, which is Volume II of this report.

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HOW TO DEVELOP TASK SUMMARIES FOR SOLDIER'S MANUALS
VOLUME I: TECHNICAL REPORT

This volume is a discussion of research that resulted in a system for developing task summaries. It is written primarily for people who will evaluate the system, including those who determine policy and others who are involved in related research. It is also intended for developers of task performance instructions (TPI) and their supervisors to supplement Volume II of this report. Developers should read that first, then scan this report later.

BACKGROUND

Soldier's Manuals (SM) were first introduced in 1976 to describe "in detail the tasks that are critical to survival and successful mission performance" for every soldier. These manuals were intended to be "a well-illustrated one-stop training and evaluation guide."[1] First, we will consider some problems with the manuals, and then some of the findings of research on the design of printed instructions.

PROBLEMS WITH SOLDIER'S MANUALS

Survey

The effectiveness of current Soldier's Manuals is evaluated in an unpublished survey by American Institutes for Research (AIR) under contract with the US Army Research Institute for the Behavioral and Social Sciences (ARI).[2] In considering the survey results, one should bear in mind that the survey method is appropriate for revealing symptoms of problems, but it is not likely to generate a coherent set of design principles. The survey team offers many useful suggestions, but they are limited in the extent to which they can extrapolate from their data.

General opinions on Soldier's Manuals. The Soldier's Manuals are regarded as generally a good idea by officers and senior enlisted people, but substantial problems remain. Their purpose is often ambiguous, particularly in relation to career advancement. Apparently, many soldiers do not use SM at all. When SM are used it is usually in preparation for Skill Qualification Testing (SQT), and not for job duties. SM are not widely used in conjunction with other training, such as Advanced Individual Training (AIT).

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[1]US Department of the Army. TRADOC Circular 351-28. Fort Monroe, Virginia: TRADOC, 4 December 1978, para 3-1a, Chapter 3.

[2]Information/Review copy of draft report, Evaluating effectiveness of Soldier's Manuals. Alexandria, Virginia: US Army Research Institute for the Behavioral and Social Sciences, 1980.

Soldier's Manuals are used more often in combat Military Occupational Specialties (MOS) than for jobs where the people perform their intended function daily. That would suggest that non-combat jobs might require different techniques of training and evaluation than combat MOS.

Completeness. While the survey report generally supported the idea of a "one-stop" Soldier's Manual, it revealed some problems with that concept. Opinions were rather evenly divided on whether the SM were incomplete, about right, or were too bulky already. The dilemma of detail versus bulk, however, may be somewhat an artifact of the survey method. The TPI revisions in Volume II include many cases in which the original instructions were both insufficient and unnecessarily long, because parts were vague, verbose, redundant and irrelevant. The survey report suggested ways to repackage SM to save bulk.

Format. The survey report suggested that a standard format be adopted. It noted the awkwardness of the term "performance measures," and suggested "task steps" instead. They noted a need for describing "initiating cues to performance of the task"; that is, the circumstances that would call for performance of the task.

Readability. Most soldiers found the words in SM easy to understand. But many samples were found to be rather difficult according to readability formulas, in relation to the average soldier's reading skills. The median sample was at the 10th to 11th grade level of reading difficulty. That paradox may also be an artifact of the survey method, because of the respondents' expectations. Most people are so accustomed to poor technical writing that they do not appreciate how much better it could be. The current SM are a substantial improvement over other manuals, even though they are far short of the ideal.

Other problems. The survey reported an almost total lack of field testing of SM or tryouts of any kind. It also reported problems with the physical construction of the manuals, especially their bindings.

Suggestions From TRADOC

The following list of commonly reported problem areas was suggested by people at the SQT Management Division, TRADOC, which monitors the development of Soldier's Manuals.

1. Use of illustrations.
2. Specifying standards: product or process.
3. Supervisory tasks.
4. Generic tasks (e.g., using Lubrication Order to lubricate any one of several kinds of equipment).
5. Citing references.

6. Using test equipment (e.g., using multimeter) that is specific to the kind of equipment tested.

These problems were therefore addressed in this research.

PRINCIPLES FOR PRINTED INSTRUCTIONS

Military Studies

The military services have long been prominent in research on readability.[3] Kern, Sticht, Welty, and Hauke[4] consolidated much of the available information in a guidebook for developers of Army training literature. They distinguish between topic-oriented and performance-oriented writing, and give numerous comparative examples and problems in revision. Our system is an attempt to make the principles of performance-oriented writing more specific, particularly as applied to Soldier's Manuals.

Recent Developments

Various research disciplines are related to design of printed instructions. These have recently been reviewed.[5] Recent developments show not only increasing interest in document design, especially in civilian institutions, but also a shift in attention toward the basic structure of documents, rather than details that are measured by readability formulas.

Organizational efforts. One sign of increasing concern among civilian institutions is the rewriting of federal regulations for clarification.[6] Also, the "Clear Language Movement"[7] has led several states to pass laws requiring clear, simple language in public documents. Another positive sign is the Document Design Project which began in September 1978, under funding from the National Institutes for Education (NIE). That is a joint effort of AIR, Carnegie-Mellon University, and Siegel and Gale, Inc., "to foster clear

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[3] T. G. Sticht & D. W. Zapf (eds.). Reading and readability research in the armed services (Final Report FR-WC(CA)-76-4). Alexandria, Virginia: Human Resources Research Organization, September 1976.

[4] R. P. Kern, T. G. Sticht, D. Welty, & R. N. Hauke. Human Resources Research Organization. (P 75-3). Guidebook for the development of Army training literature. November 1976. Alexandria, Virginia: US Army Research Institute for the Behavioral and Social Sciences, (AD A033 935).

[5] D. B. Felker (ed.). Document design: A review of the relevant research (AIR-7500-4/80-TR). Washington, DC: American Institutes for Research, April 1980.

[6] L. S. Flower, J. R. Hayes, & H. Swarts. Revising functional documents: The scenario principle (Technical Report No. 10). Washington, DC: American Institutes for Research, March 1980, p 1.

[7] Ibid.

and simple writing and design of public documents."[8] Unfortunately, there is little agreement on what "clear language" or "plain English" really is.[9] But many researchers do agree on the kinds of principles that are needed to guide revisions.

Basic structure. Current research is shifting attention to the basic structure of functional documents (i.e., task related). For instance, Bond, Hayes, and Flower[10] report that the most effective revisions of a legal document involve comprehensive changes, including reorganization, more suitable format, and consideration of the reader's needs. People who make ineffective revisions think the original was understandable, and make minor changes in wording. This kind of study is a departure from earlier studies which tended to focus on the readability formulas (words per sentence and syllables per word).

Readability formulas. Some people have always questioned the efficacy of readability formulas as guiding principles, and others are adopting that viewpoint. In a recent review of the research, Kern said bluntly: "Rewriting to lower the formula's reading grade level does not increase comprehension."[11] Kern even goes so far as to suggest that writing to the formulas is actually a distraction from the more important goal of "organizing material to meet the readers' information needs." This does not mean that readability formulas are useless; they do reflect important aspects of prose, and any writing that scores badly is at least suspect. But readability formulas should not be the first thing or the only thing a writer thinks about when revising instructions.

Needed principles. A clear statement of the new direction is given by Flower, Hayes, and Swarts.[12] They define the goal as "a set of powerful principles which would allow writers to revise public documents so that they meet the needs of the readers who must use them (underlining theirs). They note that "in a large organization such as the government, most writing tasks are essentially revision rather than original composition."[13] They also relate such revision to the reader's information processing; revision should "make it easier to hold and relate manageable-sized units in short-term memory."[14] Their study is an analysis of protocol; i.e., the way people discuss a federal

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[8]Felker, op. cit., p. i.

[9]V. R. Charrow. What is "plain English", anyway? Washington, DC: American Institutes for Research, December 1979.

[10]S. J. Bond, J. R. Hayes, & L. S. Flower. Translating the law into common language: A protocol study (Technical Report No. 8). Washington, DC: American Institutes for Research (with Carnegie-Mellon and Siegel & Gale), April 1980.

[11]R. P. Kern. Usefulness of readability formulas for achieving Army readability objectives: Research and state-of-the-art applied to the Army's problem. (Technical Report 437). Alexandria, Virginia: US Army Research Institute for the Behavioral and Social Sciences, January 1980, p viii. (AD A086-408)

[12]Flower, Hayes, & Swarts, op cit., p 1.

[13]Flower, Hayes, & Swarts, op cit., p 2.

[14]Flower, Hayes, & Swarts, op cit., p 4.

regulation as they try to interpret it. They found that readers generally express the meaning of the regulation "in the form of a concrete story or event, e.g., with a Condition/Action sequence or with Agents and Actions."[15] They recommend using such expressions in revision; they call this the "scenario principle."

Research methods. Many of the recent studies are also noteworthy for using protocol analysis as a research method. The resulting principles are based on empirical generalizations of the details of the revision process, rather than a priori notions about what should be important. A similar empirical method is task analysis, which Gagne[16] has described as the most significant contribution of psychologists to military training. Recently, Sanders[17] has discussed the advantages of the empirical approach in discovering principles of instruction.

OUR APPROACH

Our research produced a model for developing task summaries, called the Task Performance Instruction (TPI) system. It involves a coherent set of principles for structural revision, consonant with many of the recent studies. These general principles, described below, will serve as an introduction to the Method section, which is a discussion of the way the TPI system was developed. The TPI system is elaborated in Volume II.

The model involves three principles of simplification: (1) relevance, (2) directness, and (3) sufficiency. They are applied sequentially as described below. Following that is a discussion of provision in the TPI system for considering the needs of particular kinds of readers.

RELEVANCE

The first step in revision is to screen the available information for relevance to task performance. Irrelevant information is eliminated.

DIRECTNESS

Directness is minimizing the number of steps required of the reader in following instructions. Often a set of instructions requires numerous steps besides those involved in task performance. By eliminating extraneous steps, revision may provide a "shortcut."

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[15] Flower, Hayes, & Swarts, op cit., p 14.

[16] R. M. Gagne. Military training and principles of learning. American Psychologist, 1962, 17, 83-91.

[17] D. P. Sanders. Educational inquiry as developmental research. Educational Researcher, 1981, 10(3), 8-13.

Any reasonable set of instructions involves a readily apparent sequence for reading. If the intended sequence is not apparent, revision must make it so before further analysis. When revision eliminates several unnecessary steps, there is an obvious simplification. Increasing directness is the primary means of reducing the load on short-term memory. Thus, it greatly simplifies the reader's task. Two techniques are used to increase directness: sorting by responses and reducing each cluster of instructions.

Sorting by Responses

The first way to eliminate extraneous steps is to sort each item of task relevant information according to the response to which it applies. In the revision there should be a cluster of information associated with each response. After each cluster of information, there is an implied "execute" command so that the reader can act on it immediately, without reading further. That is quite different from conventional instructions, which require reading everything before taking any action, and then mentally sorting out the information so that it applies to particular responses. Even if the reader is only previewing the instructions, clustering by responses provides a structure for comprehension and recall.

Reducing Each Cluster of Instructions

Another way to minimize steps is to reduce required reading for each response. The most important techniques involve special kinds of "integrated" illustrations which eliminate the need to refer back and forth between pictures and text. For example, compare Figures 1 and 2. Another technique is to eliminate redundancy in specifying responses. The most serious, most common kind of redundancy is to illustrate various responses, and then repeat it all in the text, in tiresome and confusing detail. (See Figure 1.)

SUFFICIENCY

Sufficiency is a matter of assuring that each cluster of instructional information will produce the intended response. Sufficiency consists of having (1) a comprehensive rule specifying each response, and (2) an "embedded" example involving all response elements.

Comprehensive Rules

A comprehensive rule is one that specifies the responses under all circumstances. Such a rule may be a formula, a set of qualifying conditions, or even a simple listing of all acceptable responses. For example, a comprehensive rule for any entry on a standard form may begin "Use one of the following entries:..." A similar rule may be practically comprehensive; e.g., "The following entries cover the common situations:..." Several varieties of comprehensive rules for entries on standard forms are in the revised instructions for DA Form 2408-14 (Appendix A), which was evaluated in a demonstration experiment that is described at the end of this report.

b. To check the firing wire (using M51 test set):

(1) Separate the firing wire conductors at both ends, and connect those at one end to the test set binding posts. Actuate test set. The indicator lamp should not flash. If it does, the firing wire has a short circuit (figure 2a).

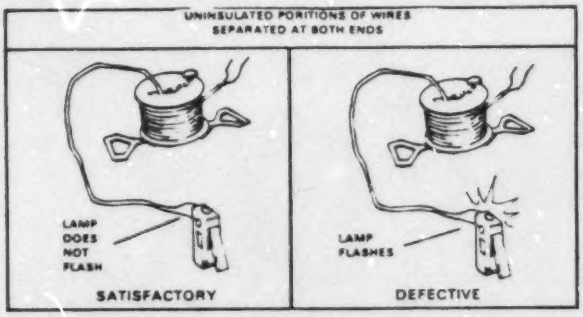


Figure 2a.

(2) Twist the wires together at one end, and connect those at the other end to the test set posts. Actuate test set. The indicator lamp should flash. If it does not flash, the firing wire has a break (figure 2b).

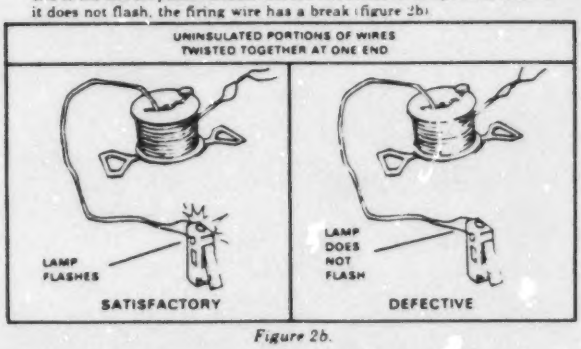
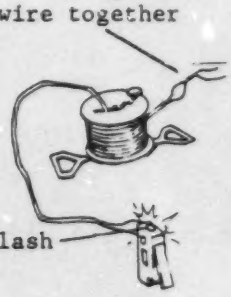


Figure 2b.

Figure 1. Original instructions.

b. To check the firing wire:
(1) Twist wire together



(2) Then untwist wire and test again: lamp should not flash

Figure 2. Revision, which integrates text and illustration.

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Embedded Examples

An embedded example of a procedure is one that is continued throughout the instructions as each response is specified by rules. This allows immediate application of each rule as it is defined. The conventional practice is to specify all responses first in terms of abstract rules, and then (perhaps) give an example. This way, the reader must try to remember abstract rules until he or she can determine where each rule applies in the example.

With embedded examples, sometimes even the rules are stated in terms of the example, with other circumstances covered only by implication. Such rules are involved in the revised instructions for "Zero the M203 grenade launcher" discussed in Chapter 5 of the Developer's Guide. The use of embedded examples is similar to the "scenario principle" proposed by Flower, Hayes, and Swarts.[18]

NEEDS OF THE READER

The principles for revising instructions should somehow take into account the various needs of readers. A method often discussed (but seldom applied) is to consider aptitude-treatment interaction (ATI) and write instructions at different levels. This does not seem either necessary or feasible for Soldier's Manuals for reasons that are discussed below. A better way of meeting particular needs is to consider task characteristics in order to give more specific rules and examples for writers so that TPI may be well suited to the tasks at hand.

Aptitude x Treatment Interaction

Felker says that:

> An aptitude x treatment interaction exists when individuals at one end of an aptitude variable perform best with one type of instructional stragegy (treatment) and individuals at the other end of the aptitude variable perform best with a different instructional strategy.[19]

The TPI system involves a working assumption that ATI is not an important consideration for SM task instructions, so long as they meet certain criteria: (1) extreme brevity, (2) hierarchical organization, and (3) coverage of all specialized concepts and operations. Brevity should ensure that no one spends much time reading the instructions. Revising TPI for any task should reduce the number of words by half or more, with even greater savings in time to comprehend them. The high degree of organization should provide more capable people rapid access to the particular information they seek.

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[18]Flower, Hayes, & Swarts, op cit.

[19]Felker, op cit., p 59.

Most SM tasks are rather simple and require little background information. If that information is not common knowledge, it should be taught within the SM as "specialized concepts and operations." Such instruction may be included within the TPI where it is needed, or taught elsewhere as a "subroutine" common to many tasks. Whichever method is chosen, there should be assurance of coverage somewhere.

A similar idea is the "skills hierarchy" that is often used in instructional analysis. This term was avoided because it seems to imply that any subordinate skill is included entirely within a higher level of performance. This is often the case, especially in mathematics. But often two tasks have only a few responses in common, so the expression "specialized concepts and operations" seems more descriptive. It also seems to describe the kind of relationships involved.

Soldiers with higher aptitude will undoubtedly be able to comprehend any instructions faster and better. But this does not justify separate sets of instructions for different levels. Such justification would require that more capable soldiers could learn even faster by another treatment, with enough advantage to warrant development of alternate instructions. Anyone who proposes alternate levels of instructions should consider the examples of revised instructions in the Developer's Guide, and try to identify parts that could be reduced or eliminated to save appreciable amounts of time for some soldiers. Instructions can hardly be too simple if they are sufficient for the task. The suggested rule is: high ability readers <u>want</u> simplicity, but low ability readers <u>need</u> simplicity.

Task Characteristics

The "needs of the reader" are primarily a matter of the task that he or she is required to perform. Therefore, a detailed task classification system was developed so that the rules and examples could be much more specific to those needs. As more TPI are developed, the classification system may allow developers to make appropriate generalizations to other tasks of the same category. The classification system may also be useful in identifying problems and issues.

METHOD

The TPI system was developed from many detailed observations of the revision process. Those observations were organized and reorganized repeatedly to better serve the goals of the system. For instance, the set of revision principles (relevance, directness, and sufficiency) was <u>not</u> conceived a priori as a coherent system. Rather, those criteria were formulated after revising many TPI, while writing about the instructions for "Uncorrected Fault Record" (DA Form 2408-14). Later those criteria were sequenced and elaborated.

The method of development may be called the empirical-differential-structural (EDS) approach. "Empirical" refers to the detailed observations that were the basis of the development. "Differential" describes the attempt to develop relatively specific guidance for different circumstances that affect development of TPI. "Structural" refers to the efforts to organize the various rules for development into a coherent system.

EMPIRICAL OBSERVATIONS

Empirical observations are based on experience that is not structured by formal experiments or explicit theory, but is subject to verification in formal experiments. The observations, for the most part, were made by the author about his own revision of instructions. The method is similar to protocol analysis, but the revision is done by researchers themselves.

Such observations are a form of task analysis. When the observations are summarized as systematic practices, they gain some credence on rational grounds. Here task analysis is considered as a research tool for developing instructional methods, rather than a production method.

DIFFERENTIAL TECHNIQUES

Principles that are effective for developing one kind of instruction may be ineffective or inapplicable under different circumstances. An important research objective was to determine what kinds of circumstances made that kind of difference. Those circumstances were generally related to the kind of task that the soldier is to perform.

Consider, for example, the difference between procedures with equipment and procedures with data. The basic consideration is that procedures with data require written responses, which are easy to specify in printed instructions. That makes development of TPI much easier, if the procedures involve only data, so the distinction is useful. Procedures with equipment, on the other hand, involve specification of motion, parts of equipment, viewpoint, and sometimes other crewmembers. The distinction is not in terms of basic processes involved in task performance, because those processes are not unique; procedures with equipment generally involve some kinds of data.

The task examples were selected to be representative of the kinds of problems that developers would face. There was a deliberate attempt to select tasks and problems that were different from those previously encountered.

STRUCTURAL DEVELOPMENT

The various distinctions that seemed related to training methods were organized into three classifications: (1) kinds of tasks, (2) components of illustrations, and (3) functions of illustrations. The classification of tasks was designed as a tool for task analysis. Each kind of task is discussed separately, allowing the guidebook to be relatively specific in suggesting instructional strategies.

The classification relating to illustrations were used to derive techniques for relating words and pictures directly, and to promote skill in using "action" illustrations to specify responses. However, they were too elaborate for discussion in a basic guidebook.

The classification systems and other aspects were interrelated by similar means, so as to provide an effective, systematic and easy-to-follow method for developers. There was frequent rearrangement of the system as more TPI were revised and rules formulated.

DEMONSTRATION EXPERIMENT

A demonstration experiment was conducted comparing effectiveness of original and revised instructions for the "Uncorrected Fault Record" (DA Form 2408-14). The revision followed the TPI system, as discussed in Chapter 5 of the Developer's Guide, so the results should indicate efficacy of the method.

PROCEDURE

Twenty-six college students tried to find six errors in a military maintenance record. They used standard technical manual instructions (TMI) one time and TPI another time for this unfamiliar task. The order in using TMI and TPI was counterbalanced with two alternate forms of the maintenance record test. All students were also asked to rate their confidence in their answers and to compare the instructions for ease in understanding. Twenty minutes were allowed for each attempt to use the instructions on the test maintenance record. The time allowance was more than enough for all students completing the tests. Three others were dropped because they could not or would not complete the task with the original set of instructions. The problem and answer sheet is shown on the following page, along with the rating scales.

RESULTS

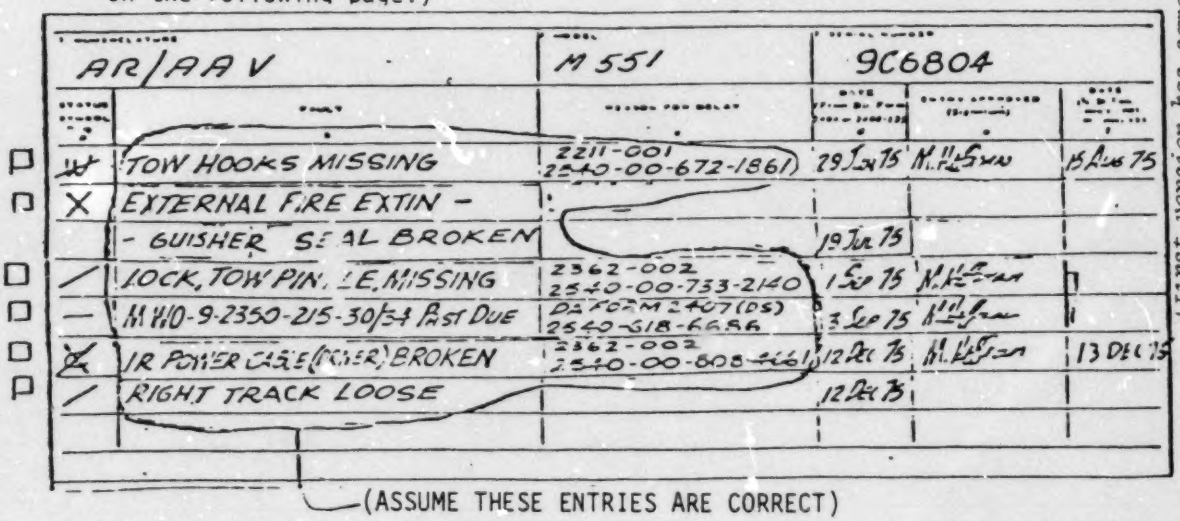
The revised instructions were significantly better on all three measures: greater accuracy, greater confidence, and easier to follow ($p < .01$, each criterion, sign test). The raw data are shown in Table 1. The only individual who scored better following the original instructions was below chance on both versions of the task.

TPI was much better than TMI, but TMI was very poor. Only four percent of students using TMI found all six errors--as compared to 28% of TPI users. If the aim of TPI is to lead unfamiliar students to perfect test performance, then TPI could also be improved. However, this was simply a demonstration experiment. The percentages cannot be taken to estimate performance parameters for realistic samples of military tasks or soldiers. Further research is needed in order to demonstrate the validity of the system with respect to other kinds of tasks.

IMPLICATIONS

The demonstration merely shows the direction of differences and suggests that very large gains may be expected relative to poor existing instructions. The important practical implication is that such simple counterbalanced designs might be used in practice to ensure that the TPI meet the needs of the users. The student ratings of confidence and ease in following instructions were markedly in the expected directions. If the experiment has been conducted as part of the TPI developmental process, the students might also have suggested useful specific improvements in the TPI. Such demonstration experiments in the course of TPI production would finally show the point of diminishing returns in any practical program to improve performance.

Assume that you are a supervisor checking the entries in this "Uncorrected Fault Record" form. Which of these entries are wrong? (See instructions on the following page.)



(first version has same entries, different sequence)

After you are through, answer these questions:

How confident are you of your answers?

random guess	unsure	fairly confident	confident	extremely confident

Which set of directions were easier to follow?

1st much easier	1st a little easier	about even	2nd a little easier	2nd much easier

(last question is not included in first version)

TABLE 1. Comparative Data on Original and Revised Instructions for Uncorrected Fault Record

*Subject No.	Original Score	Original Confidence	Revised Score	Revised Confidence	Relative Ease
1	4	5	6	4	5
2	3	2	6	4	5
3	3	1	5	3	4
4	2	3	4	5	5
5	4	3	6	4	5
6	3	2	4	4	4
7	3	2	6	4	5
8	5	3	6	4	4
9	4	3	5	4	5
10	2	2	6	4	5
11	6	2	6	4	4
12	2	1	4	3	5
$\bar{x}$	3.42	2.42	5.33	3.92	4.67
13	4	3	6	3	4
14	3	3	4	4	3
15	2	1	1	1	3
16	4	3	6	4	4
17	4	2	4	3	4
18	4	3	6	4	5
19	4	4	5	5	5
20	5	4	5	5	4
21	5	4	6	5	4
22	4	3	5	3	4
23	6	3	6	4	5
24	4	3	6	4	4
25	4	3	5	3	4
26	4	2	6	4	4
$\bar{x}$	4.07	2.93	5.07	3.71	4.00
Overall x (both orders)	3.74	2.69	5.19	3.81	4.31

Score	Confidence Scale		Relative Ease
maximum possible is 6	1 - random guess	1 -	original much easier
	2 - unsure	2 -	original a little easier
	3 - fairly confident	3 -	about the same
	4 - confident	4 -	revised a little easier
	5 - extremely confident	5 -	revised much easier

*Subjects 1-2 used the original instructions first, and 13-26 used the revised instructions first.

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APPENDIX A

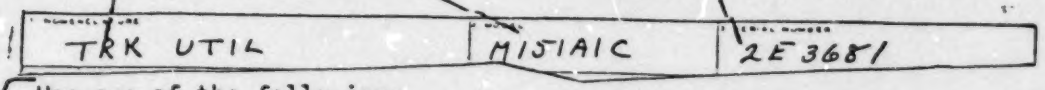
Original Instructions and Revised Instructions for
"Uncorrected Fault Record"
(DA Form 2408-14)

TASK: Fill Out DA Form 2408-14

Conditions: In filling out DA Form 2404 there was a fault that could not be corrected immediately, but the equipment was still operable. (This page is for equipment other than aircraft. Aircraft faults are discussed on the following page.)

Use nomenclature and model numbers from TM-38-750, Appendix E

From vehicle inspection log, or from nomenclature plate on vehicle



Use one of the following:
- x = deferred maintenance action, equipment still operable
- / = deficiency that only degrades efficiency
- - = potentially dangerous

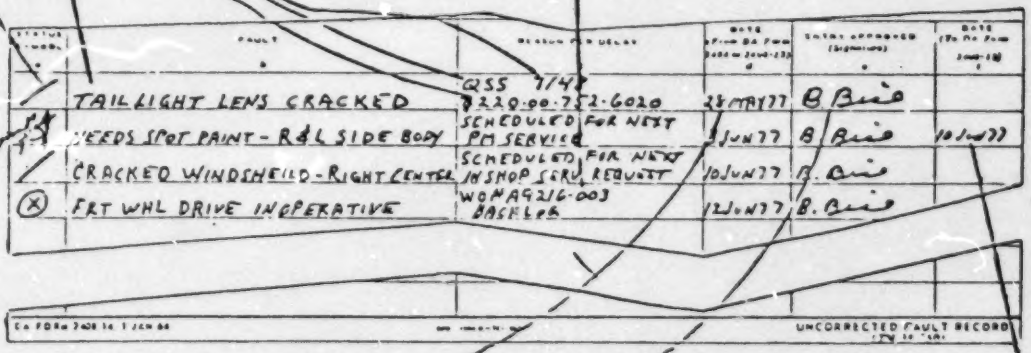
(defined in TM-38-750 para 4-2 c(1))

Do not use "x" because it means the equipment is inoperable, and you should use DA Form 2407

Do not erase status symbol if it is an error. Instead, draw a line through the whole entry and start again on the next line.

Copy verbatim from 2404, column c.

Give reason for delay and information about action taken, such as:
- NSN (National Stock Number)
- QSS or SSSC
- Julian date that part was requested
- Work order number (in case of backlog)



Date of entry

Signature of commanding officer or designated representative.

When the fault is corrected, the person who does it writes the date in the last column and his last name initial over the status symbol.

Disposition: Six months after the last fault is corrected, this form may be discarded.